Chapter 5. Conclusions

The following conclusions can be drawn based on the analysis presented in this report:

- Between 1937 and 1993, the area of riparian forest and scrub in the study area decreased from 6,787 to 4,914 acres, a 28% reduction, and the area of herbaceous riparian vegetation and marsh decreased from 4,076 to 738 acres, an 82% reduction.

- Between 1937 and 1993, the area of agricultural and disturbed land increased from 37,725 to 39,596 acres, a 5% increase, while the urban and industrial land use acreage, including aggregate mining, increased from 300 to 2,581 acres, an 860% increase. The largest acreage changes occurred between 1937 and 1957.

- Changes in riparian habitat area could be attributed to several causes:

  - land use changes, including direct effects of conversion of natural habitat for agricultural development, aggregate mining, and urbanization;

  - hydrologic changes, including the loss of flood flows in winter and spring and increases or decreases in summer base flow; and

  - managed wetland development in San Luis National Wildlife Refuge.

  The relative importance of these factors differed by reach:

- In Reach 1, from Friant Dam to Gravelly Ford, the most pronounced changes in land use include increases in aggregate mining and urban development and a shift from agricultural field crops to vineyards. Hydrological changes since the construction of Friant Dam, particularly a reduction in scouring floods and higher base flows in summer, appear to have caused a succession from riparian scrub to forest in the active channel and from cottonwood riparian forest to mixed riparian forest and then to valley oak riparian forest on outer floodplains. Exposed sand and gravel bars declined in area and appear to have been overgrown by willow scrub that subsequently developed into mixed riparian forest, presumably due to a reduction in flooding disturbance.

- In Reach 2, from Gravelly Ford to Mendota Dam, an increase in agricultural fields is associated with a reduction in riparian forest, scrub, and herbaceous

vegetation; more than a third of the agricultural fields were converted to vineyards and orchards between 1957 and 1993.

- In Reach 3, from Mendota Dam to Sack Dam, changes in the area of riparian habitat types since 1937 appear initially to have been the result of urban and agricultural development; after 1957, the changes appear to be largely the result of hydrological changes. The loss of scouring floods in winter and spring and the increase in summer base flows resulted in a decrease in exposed sand and gravel bars and a succession of willow scrub to mixed riparian forest. More of the active channel is now occupied by dense vegetation.

- In Reach 4, from Sack Dam to Bear Creek, riparian habitat acreage decreased between 1937 and 1957 but then gradually increased, mainly because of an increase in managed wetland area and riparian scrub in the San Luis National Wildlife Refuge and encroachment of riparian vegetation on exposed sand and gravel bars outside the refuge.

- In Reach 5, from Bear Creek to the Merced River, riparian habitats and marsh appear to have been affected mainly by the draining of marshes, causing a large decline in marsh acreage between 1937 and 1957 and an increase in riparian forest and scrub. Riparian forest and scrub declined after 1978 and grassland and pasture acreage increased.

- The usefulness of the GIS data collected in this study will greatly increase if the data are analyzed in combination with the data collected in the accompanying physical processes study. The resulting analysis of opportunities for riparian restoration would represent the next step in riparian restoration planning in the study area.